Instruction with Hands-on Practice:
Creating a Bathymetric Database & Datum Conversion
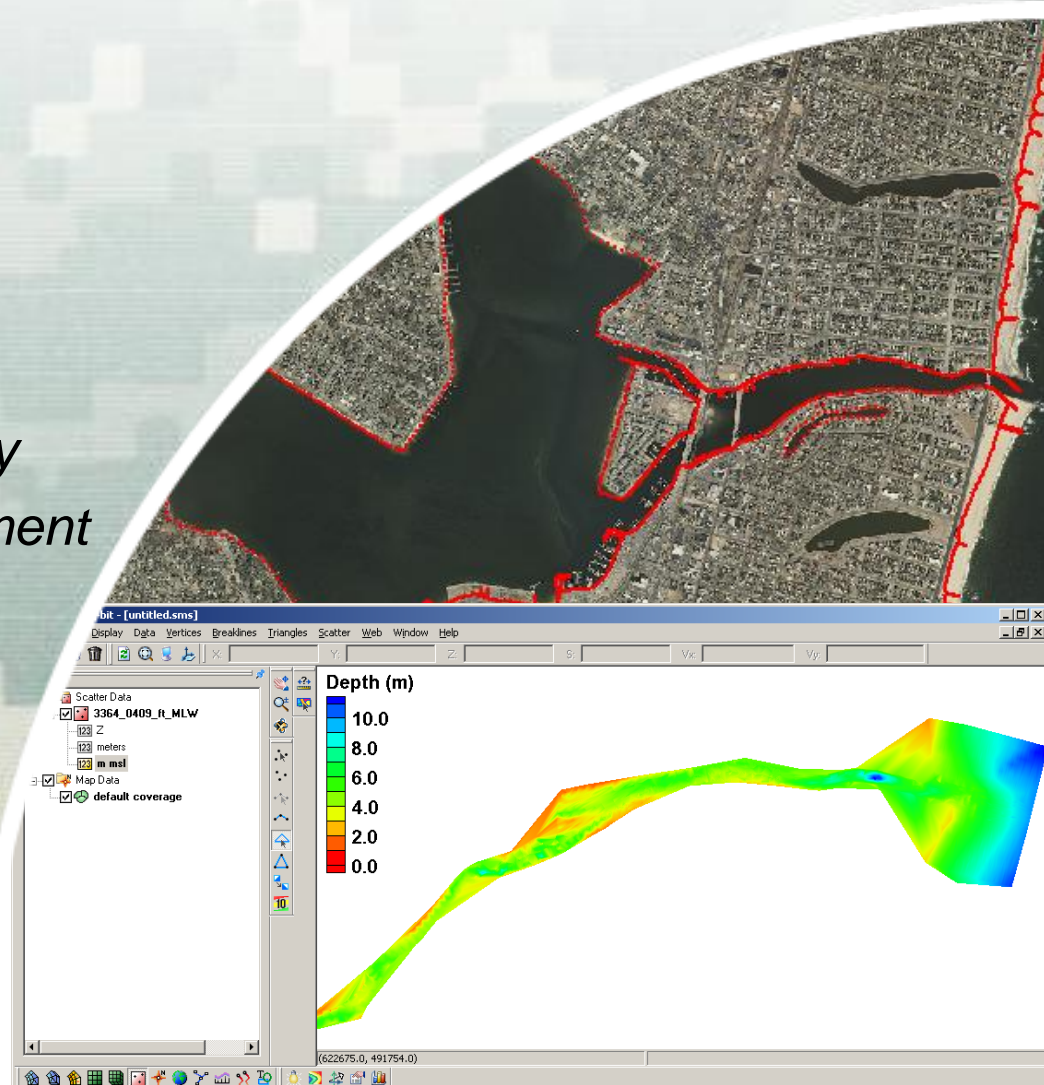
Tanya Beck

Coastal and Hydraulics Laboratory

Engineer Research and Development Center

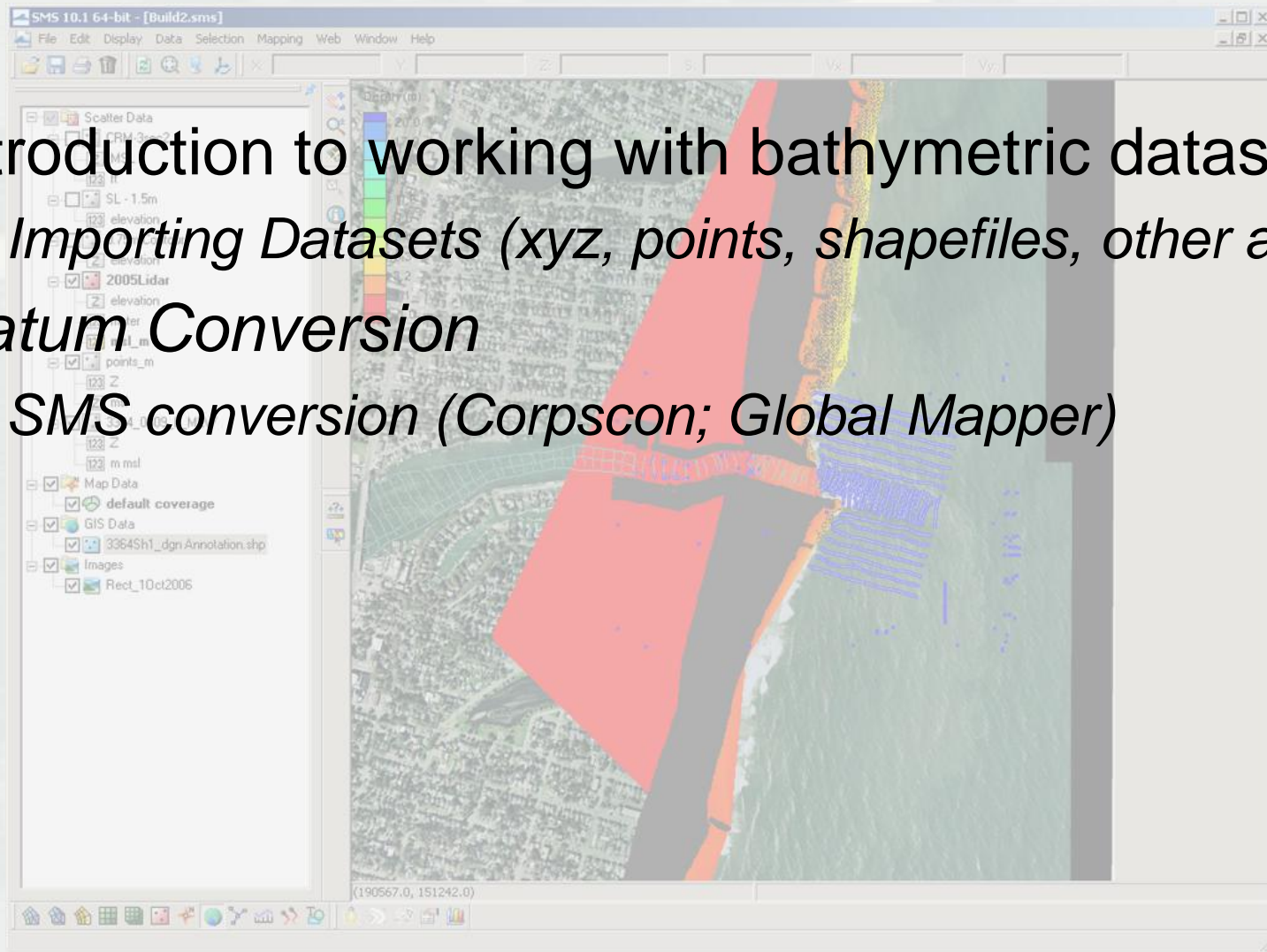May 17, 2010

US Army Corps of Engineers

BUILDING STRONG®

- Introduction to working with bathymetric datasets
  - ► *Importing Datasets (xyz, points, shapefiles, other ascii)*
- *Datum Conversion*
 - ► *SMS conversion (Corpscon; Global Mapper)*

Multiple Bathymetric Datasets

- Limited bay bathymetry

- NOAA – Offshore datasets

- LIDAR – Shoreline and nearshore (important for structure resolution)

- Channel
  - ► NJ State maintains north channel and north bay channel
  - ► Federally maintained entrance and south channel (15 years)

- NAN-supported field data collection
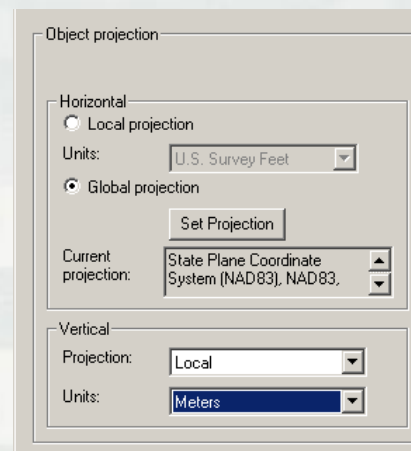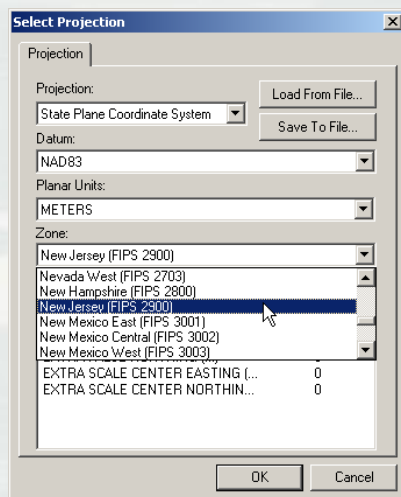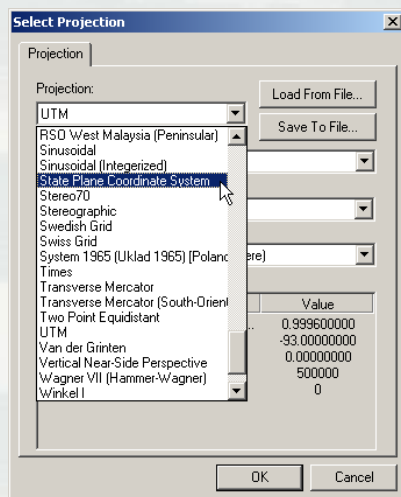 - ► Included bathymetry of the backbay (Spring High Tide)
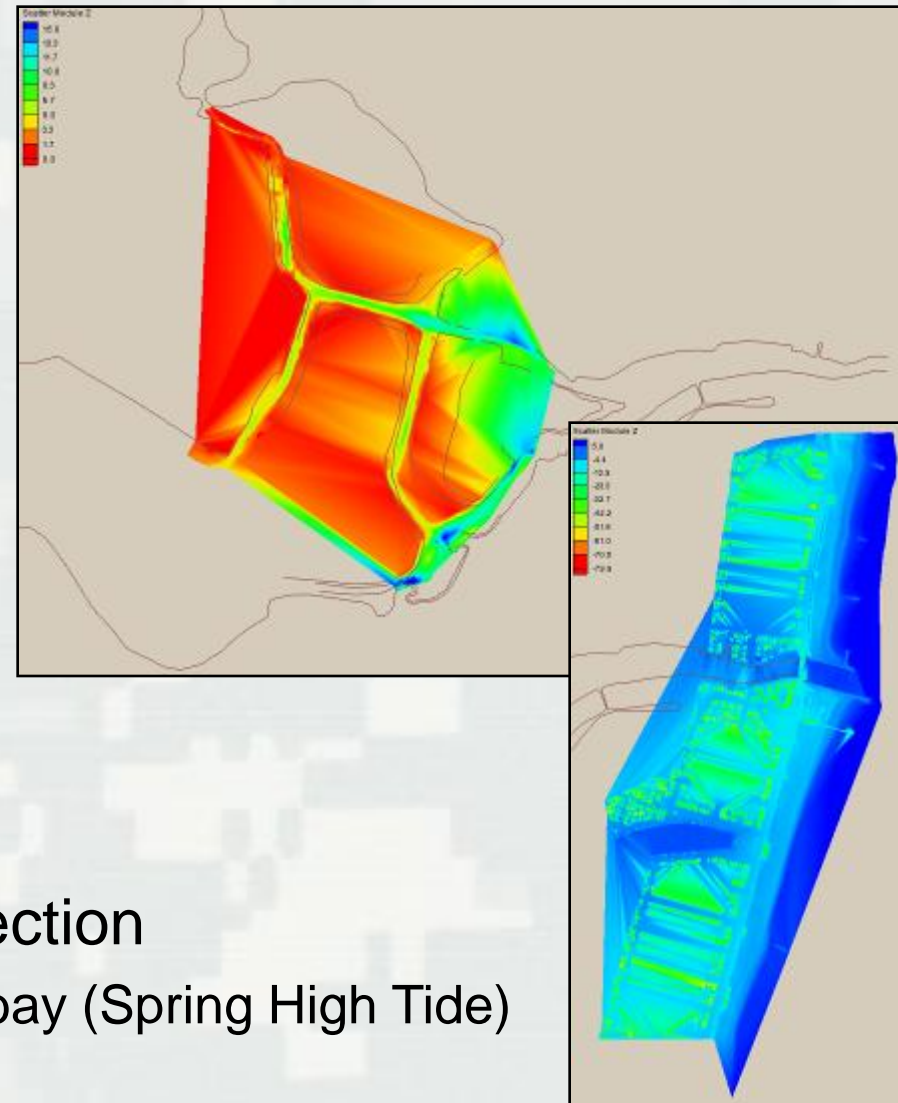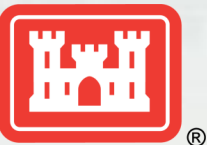
Common Spatial Reference Datum & Vertical Datum

Horizontal Projection & Datum: Pick a system in metric units that is planar (UTM; State Plane)
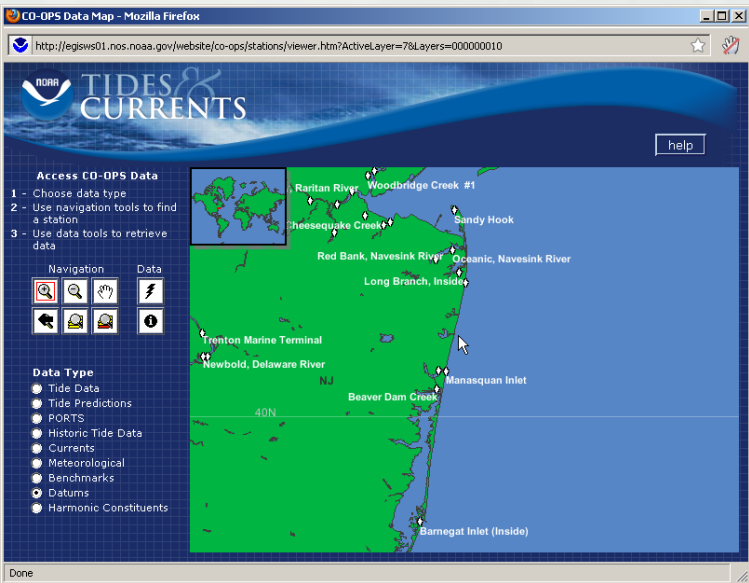
Vertical Projection & Datum: Must be in metric as well; Datum is not necessary (Local)

…Need to convert all bathymetric data

Tides and Currents (NOAA)

http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Datums
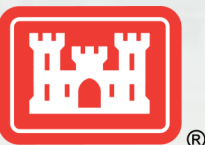
Vertical Datum Conversions

NOAA (Long Branch)

COE NAN Benchmark

NAVD 88

MSL — 0.24 ft (0.073 m)

2.25 ft (0.686 m)

1.1 ft (0.335 m)

NGVD 29

1.59 ft (0.485 m)

1.9 ft (0.579 m)

NAN Surveys
MLW → MSL
+ 2.76 ft (0.841 m)

MLW

0.18 ft (0.055 m)

MLLW
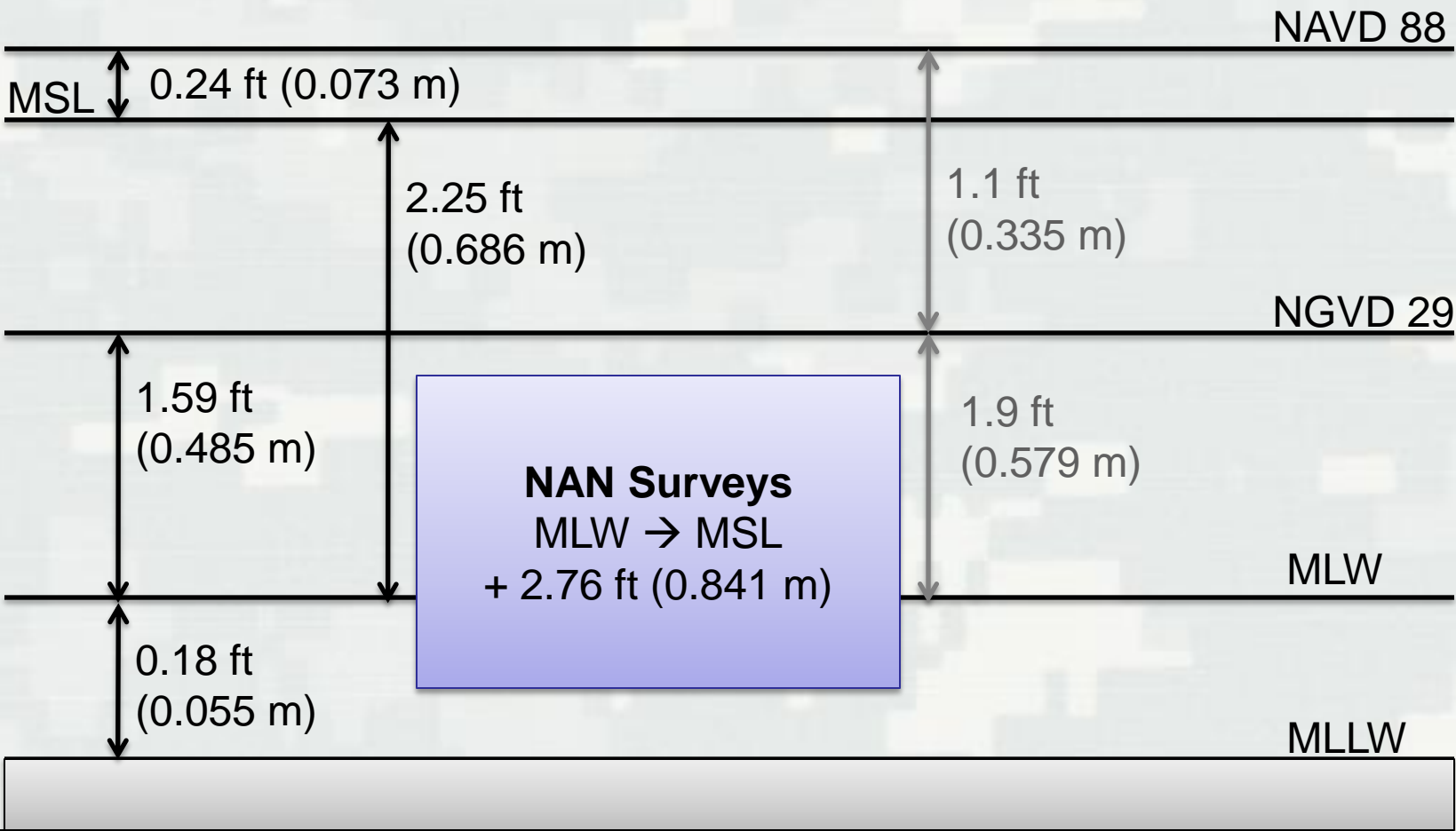
Prep for the Coastal Modeling System

- Based off of a Cartesian grid
  - Planar coordinate system
  - Model computation is in metric and depths are positive from zero (elevations are flipped)
  - Grid is generated based off of a single bathymetry file stored in SMS scatterset file format
  - Vertical datum is not specified and is assumed local
    - The boundary condition forcing (tidal) must be in the same datum as the bathymetry
    - Typically modeling grids are brought to a mean datum such as mean sea level (msl) or mean tide level (mtl)
- → This requires that all datasets are brought in to unified projection, datum, and units
 - Shark River Inlet bathymetry will be converted to State Plane horizontal coordinates in meters with the vertical datum set to MSL in meters

Object Projection tells SMS the present projection.

Checking "Specify" Project Projection is used to change the projection.

It will physically change the coordinates of everything loaded in SMS.

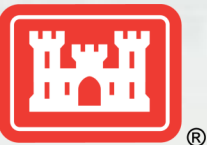The projection settings are saved in the SMS project file (*.sms).

Converting Elevations to Depths (CMS Requirement)
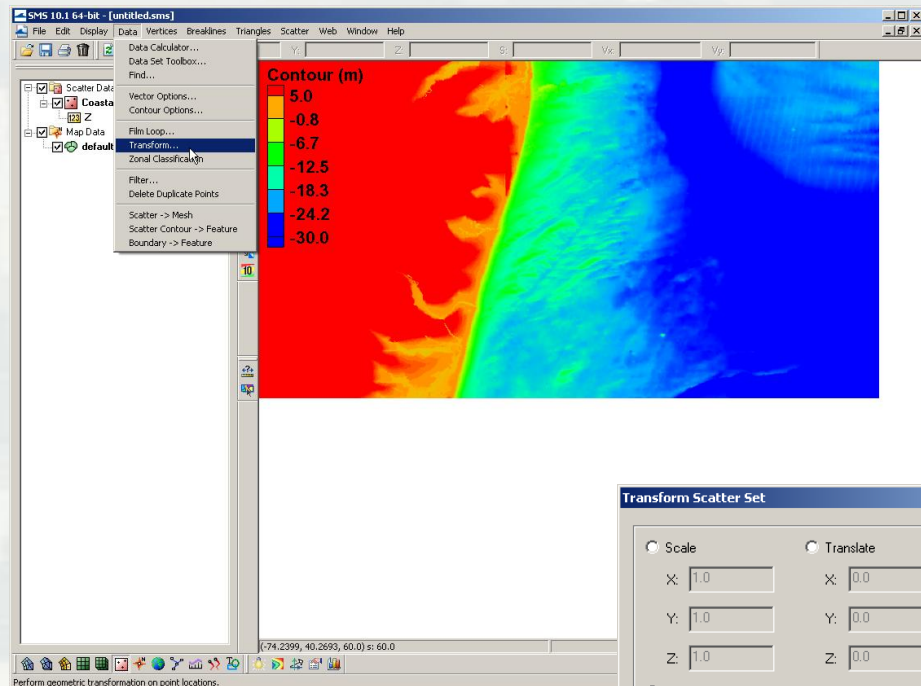
Data → Transform
Can adjust scatterset data by scaling, translating (adding/subtracting), or rotating horizontal or veritcal

Select Depths ←→ Elevations
Flips negative elevations to positive depths.
Necessary for CMS model calculation.

CIRP

15 Year Record of Bathymetry

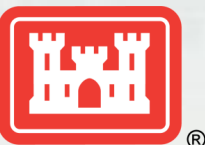| Date	Survey Type	Date	Survey Type
1-Jan-1995	Condition	28-Mar-2007	Condition
6-Jan-1998	Condition	30-Aug-2007	Before Dredge
6-May-1999	Condition	4-Jan-2008	After Dredge
11-Apr-2000	Condition	25-Mar-2008	Condition
16-Apr-2002	Condition	9-Jun-2008	After Dredge
6-Dec-2002	Before Dredge	31-Oct-2008	After Dredge
18-Jan-2003	After Dredge	8-Dec-2008	Before Dredge
7-Jul-2003	Condition	6-Jan-2009	After Dredge
7-Aug-2003	After Dredge	15-Apr-2009	Before Dredge
28-Apr-2004	Condition	1-May-2009	After Dredge
10-Jun-2005	Condition	20-Aug-2009	Before Dredge
23-Dec-2005	After Dredge	10-Dec-2009	After Dredge
23-May-2006	Condition	6-Jan-2010	After Dredge
27-Nov-2006	Condition		
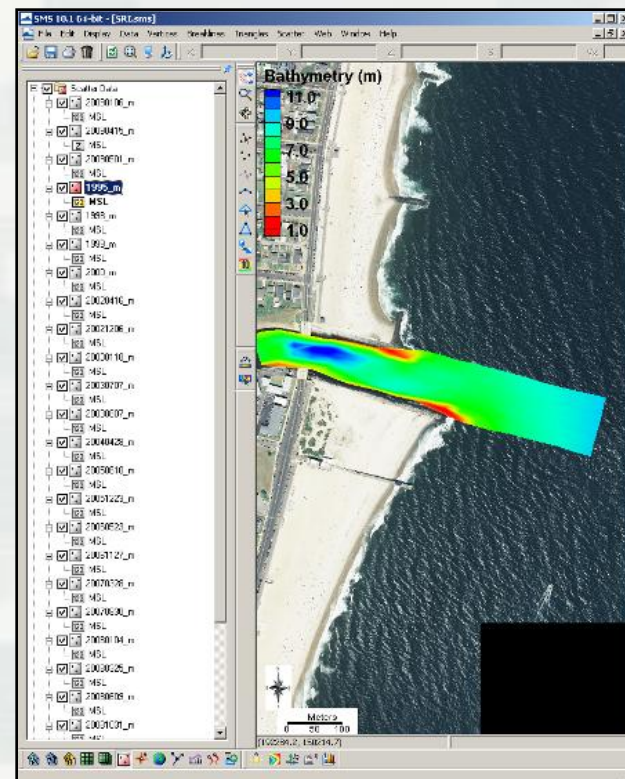
Horizontal Datum:

State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:
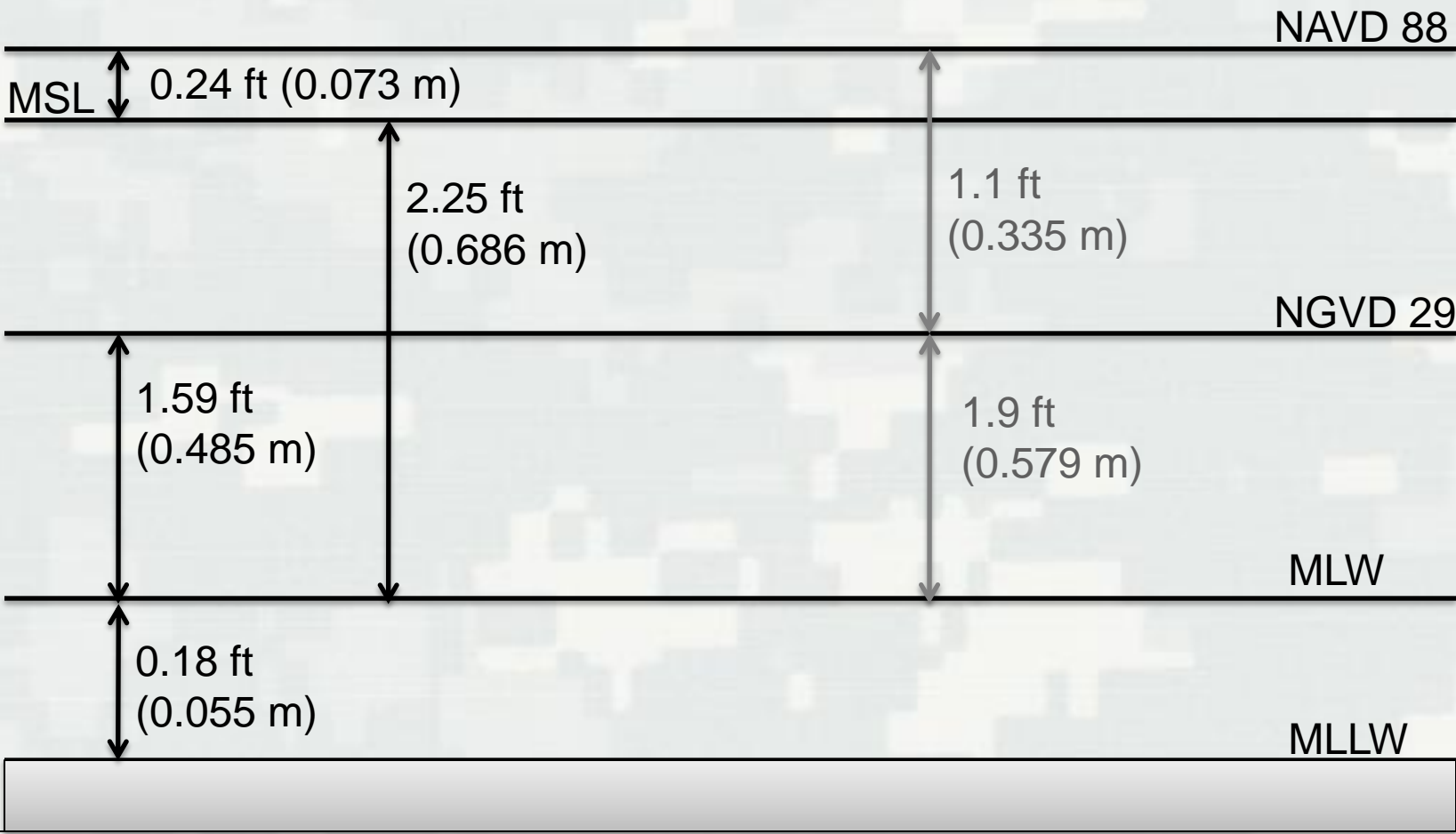
MLW (ft) – COE Datum (not local NOAA benchmark)
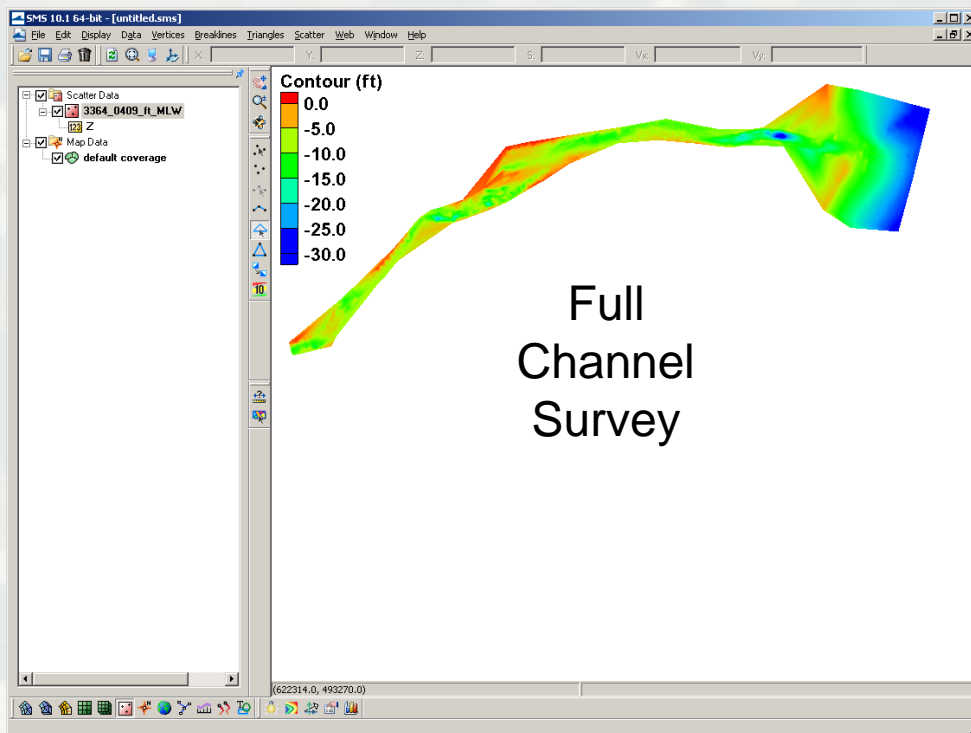
Conversions
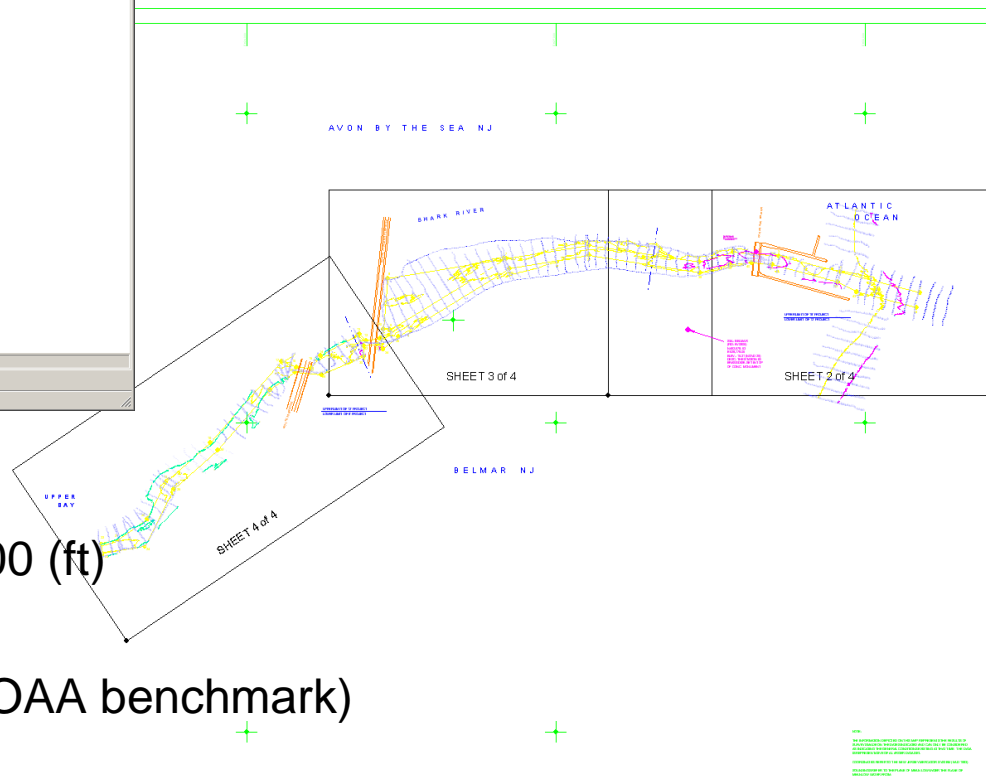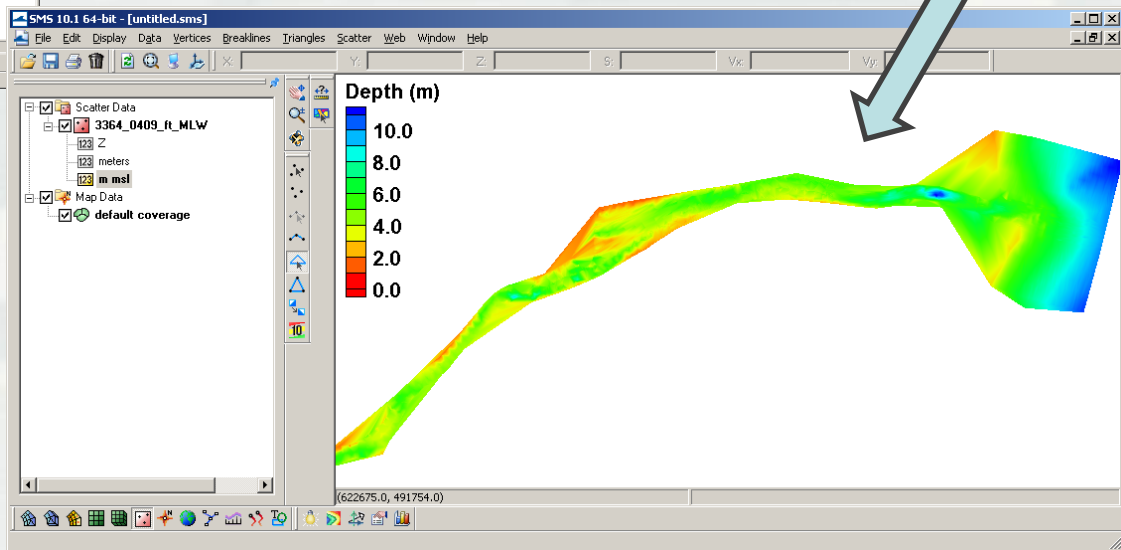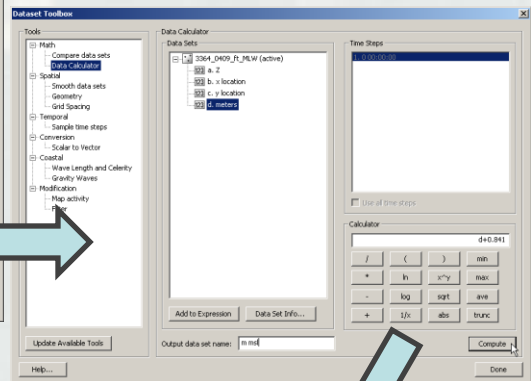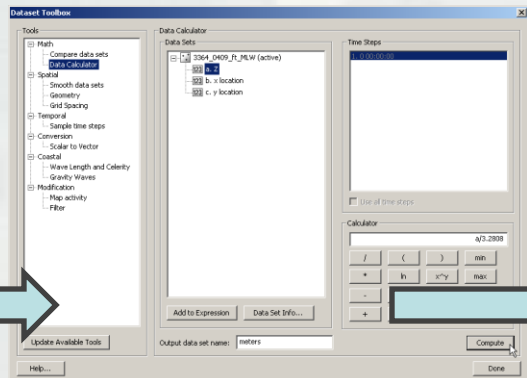

NOAA (Long Branch) **COE NAN Benchmark**

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2.25 ft (0.686 m)   1.1 ft (0.335 m)

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MLW

0.18 ft (0.055 m)

MLLW

NAN Surveys
MLW → MSL
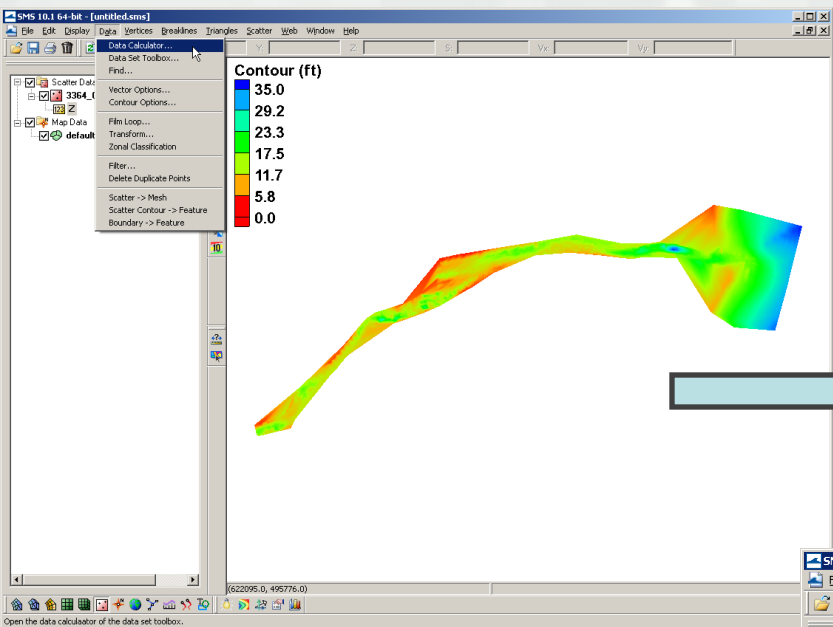+ 2.76 ft (0.841 m)

Horizontal Datum:
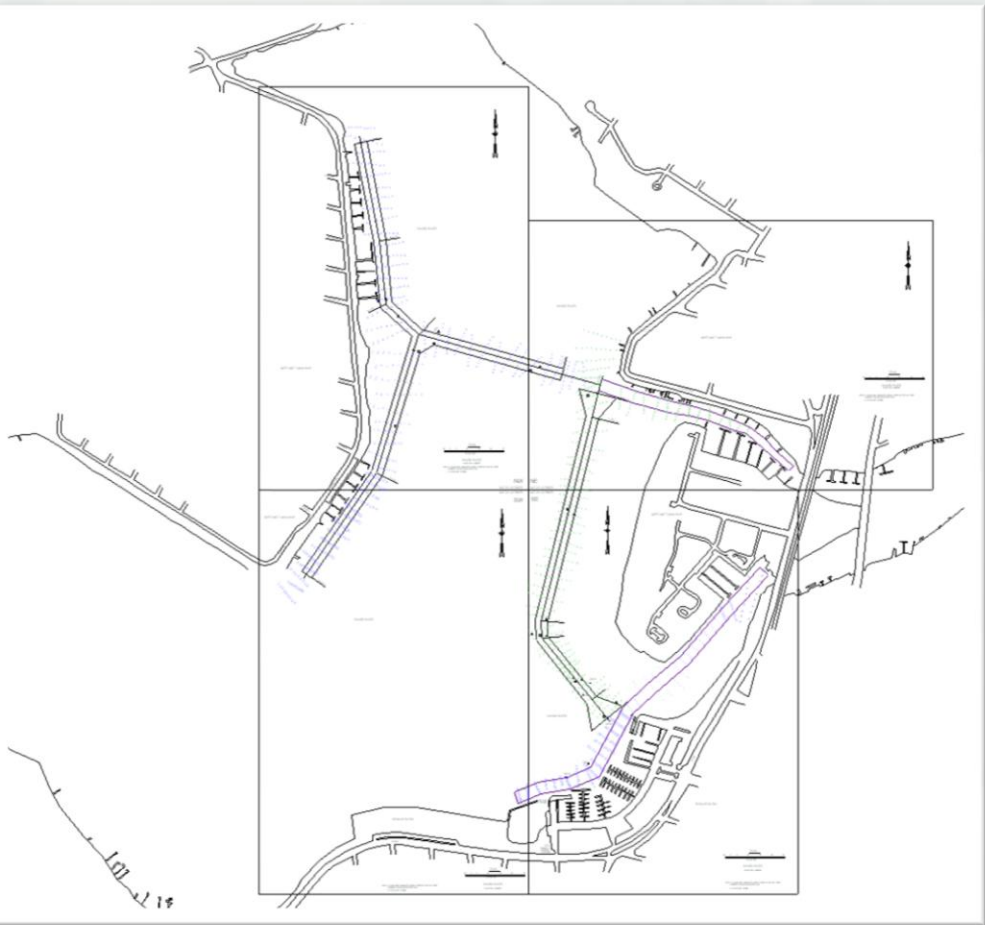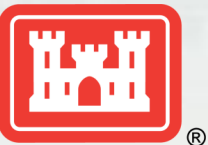
State Plane NAD27 New Jersey 2900 (ft)

Vertical Datum:

MLW (ft) – COE Datum (not local NOAA benchmark)

Dataset Calculator

NJ DEP Channel Surveys
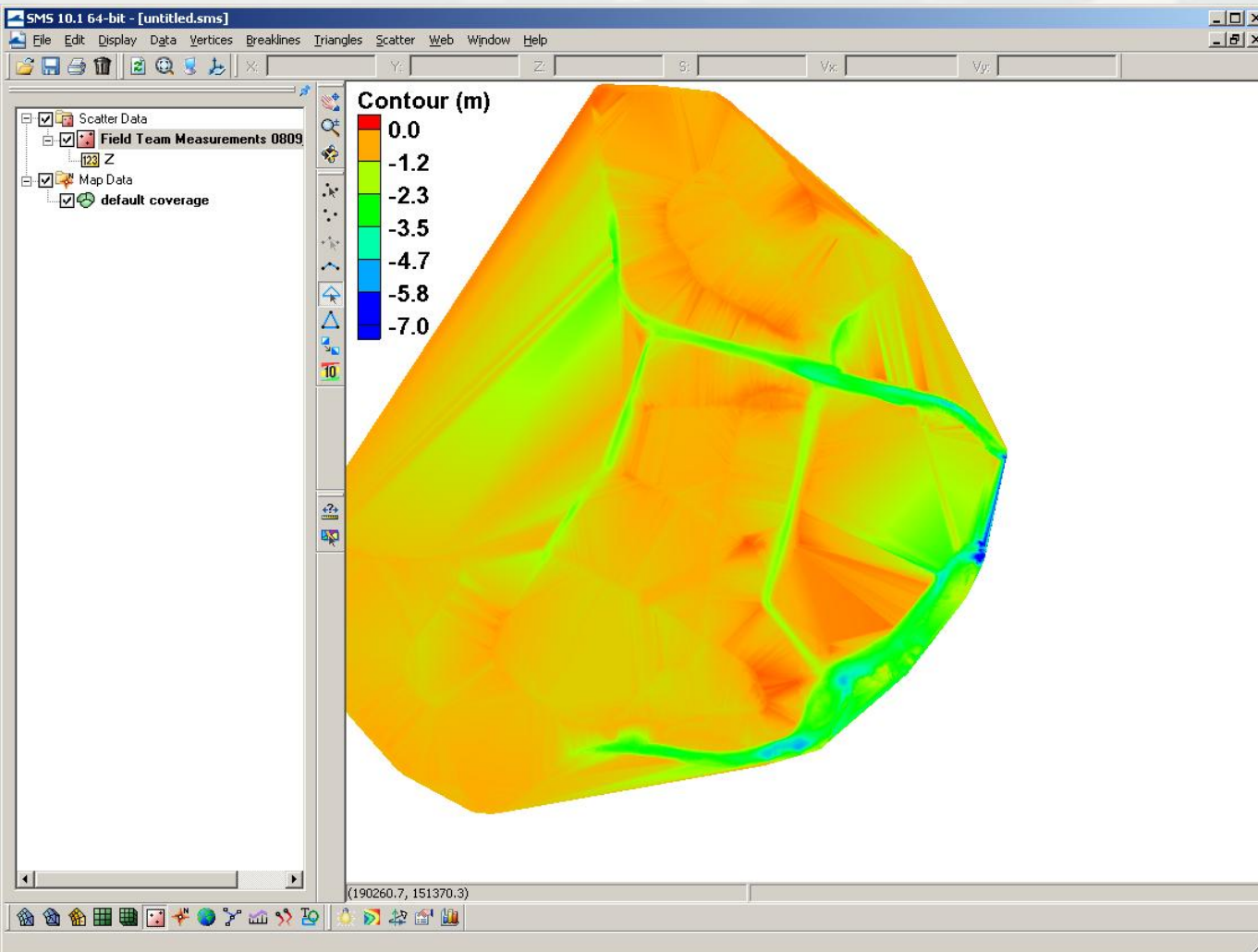

June 2009
Survey
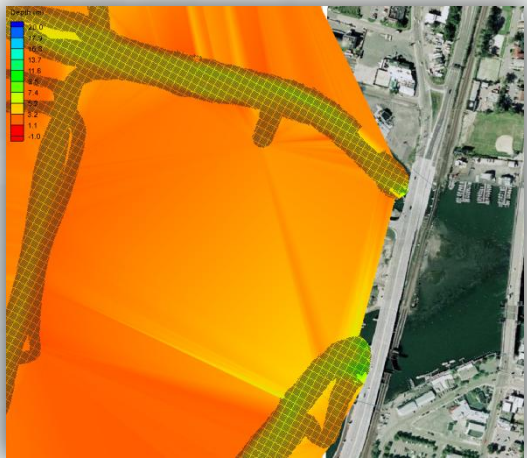
Provided conversion from local datum
to NAVD88:

MLW → NAVD88
+ 2.41 ft (0.735 m)
MLW → MSL
+ 2.17 ft (0.661 m)

XYZ pulled out of drawing and
changed to ascii format

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (m)

Vertical Datum:

NAVD88 (m)

LIDAR

- Files are emailed in separate sections from the NOAA CSC Archive
  - Typically several to 10s of files that are 5 - 100 mb in size
- Compiling takes time
  - Points have been sampled/filtered and cropped to area of interest

Horizontal Datum:

State Plane NAD83 New Jersey 2900 (ft)

Vertical Datum:

NAVD88 (ft)

Depth (ft)
82.0
65.0
48.0
31.0
14.0
-3.0
-20.0
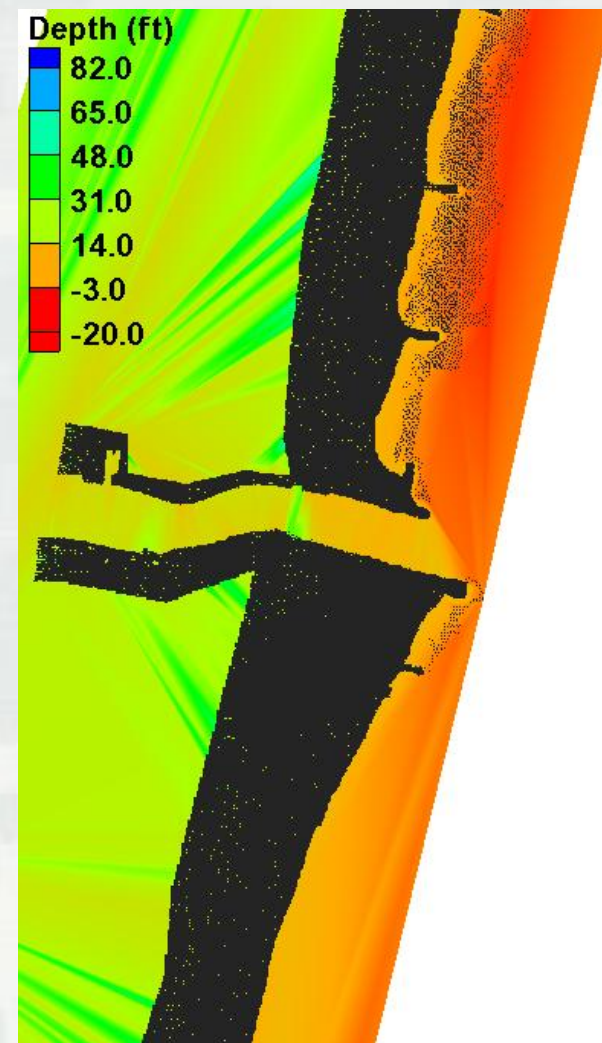
Coastal Relief Model (DTM/DEM)

Generate a 3 sec
(pt/3rd second) grid

Coastal Relief Model
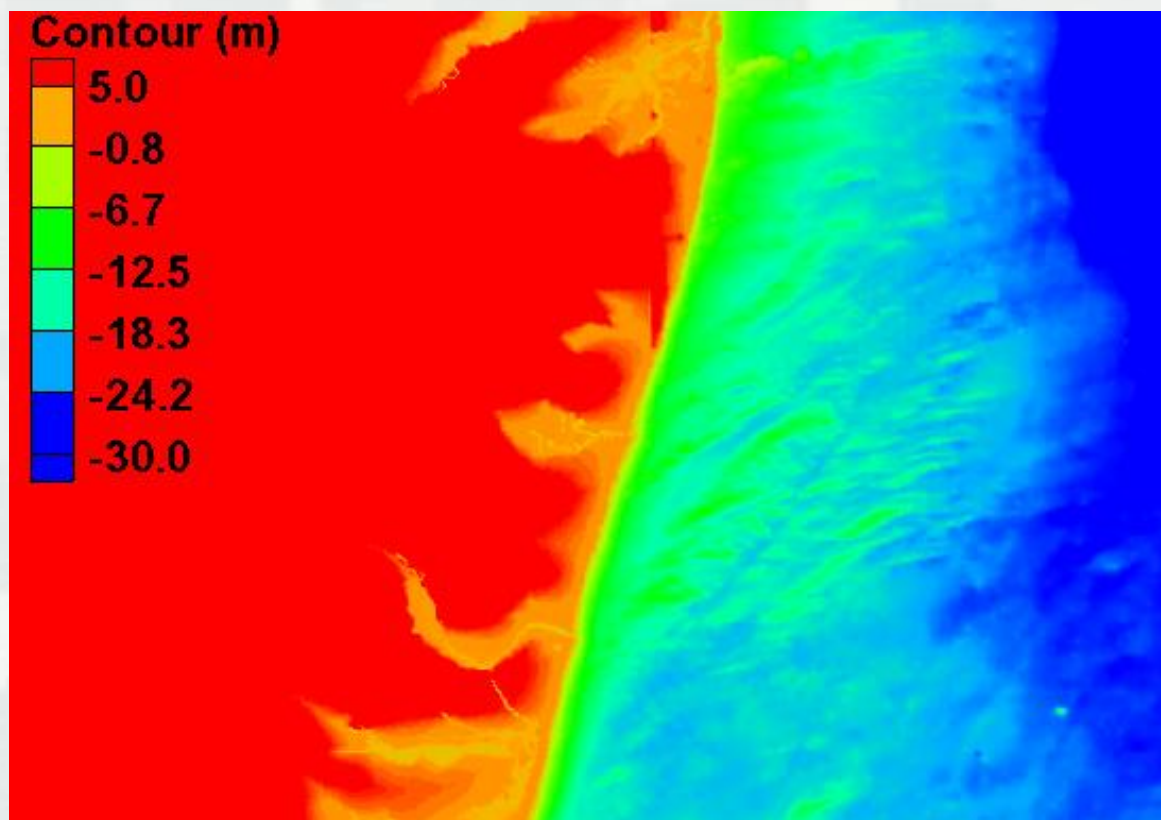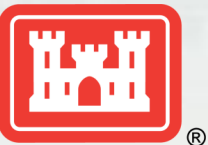
Horizontal Datum:

Geographic NAD83

Vertical Datum:

MSL (m) – Not accurate for shallow bathymetry (used for offshore)

- Convert shoreline shapefile in SMS
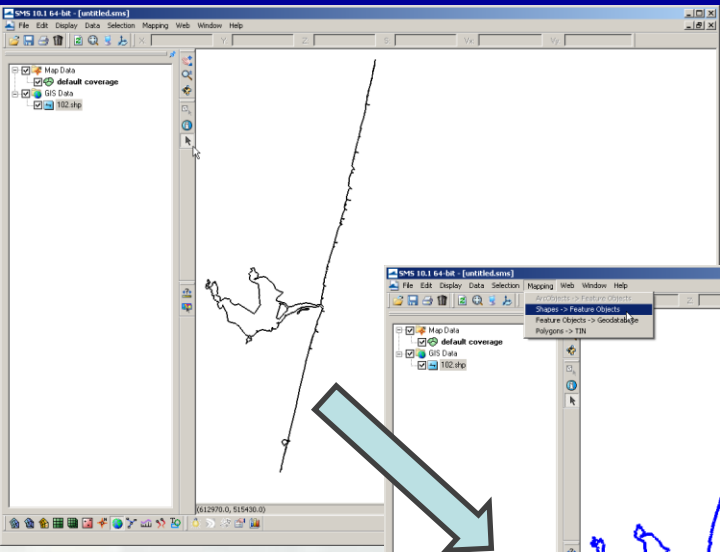
Horizontal Datum:

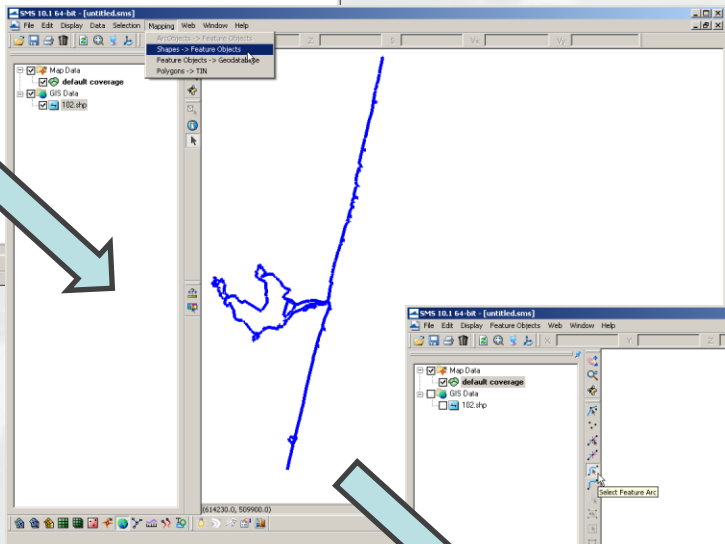 State Plane NAD83 New Jersey 2900 (ft)

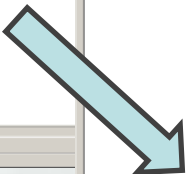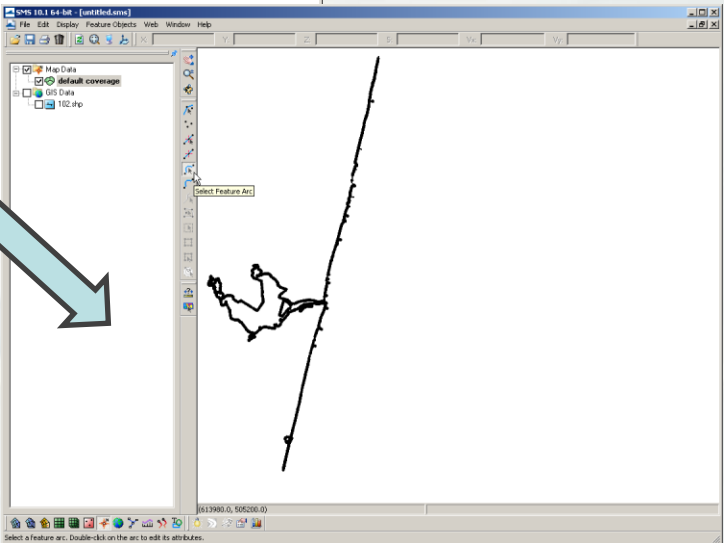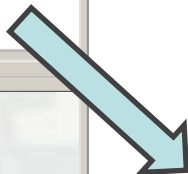- Added extra bay contour (set to -0.75 m)

Convert a Shapefile to Map
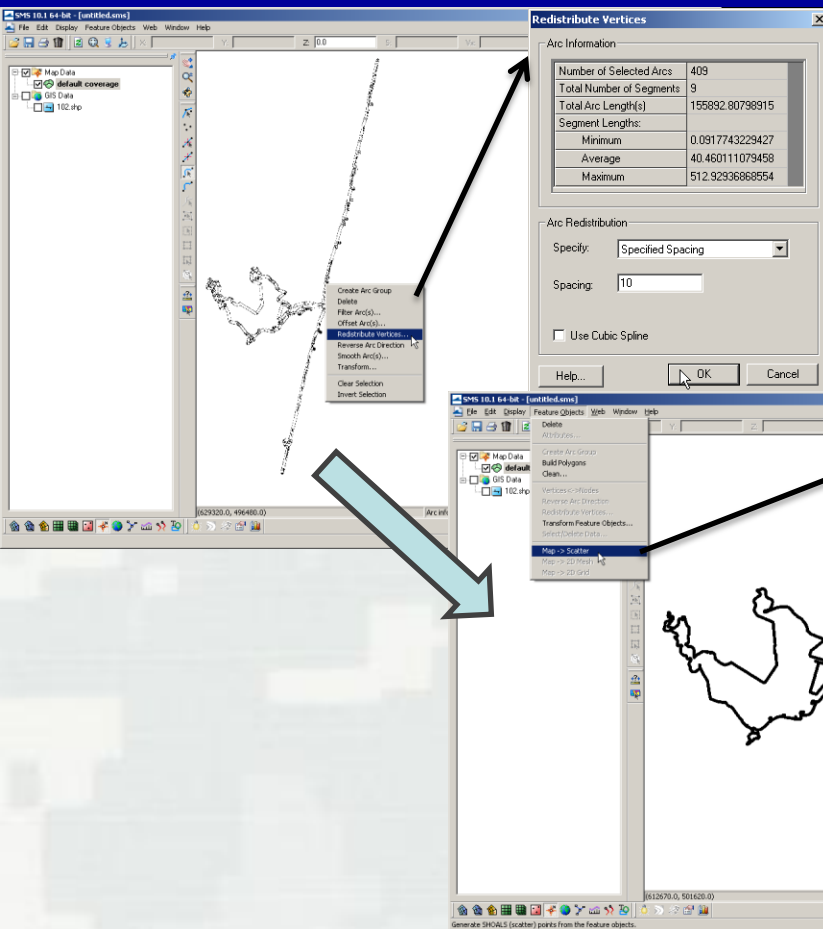

Drag and drop the shapefile (.shp)

Highlight all Coastline
Mapping – Shapes→ Feature
Objects

Turn off GIS Data
Arcs generated
from GIS
shapefile

Convert a Map to Scatter

Highlight all Arcs
Rt-Click → Redistribute Vertices
Specified Spacing (spacing in spatial coordinates)

Feature Objects
Map → Scatter
Include all feature points and vertices (vertices spacing was set to 10)

Modify as necessary (i.e. remove entrance channel shoreline because it is old seawall and jetty configuration – LIDAR used here)
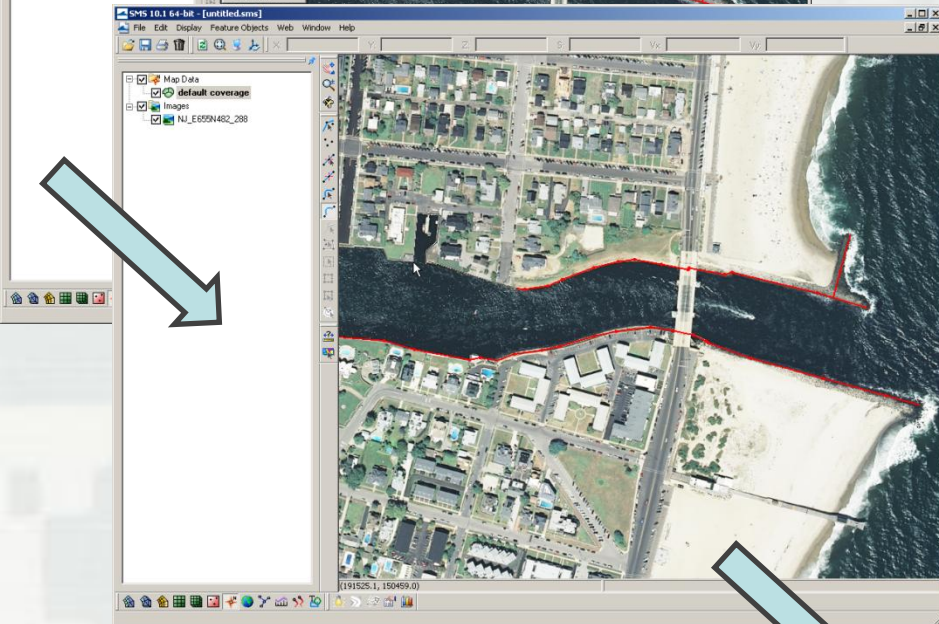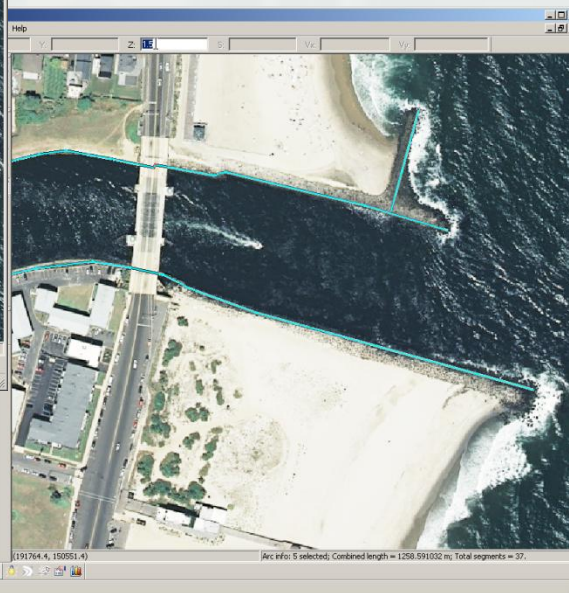
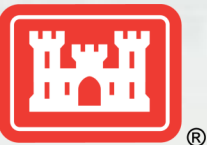# Create a Contour Polyline in the Map Module

Select Default Coverage under Map Data
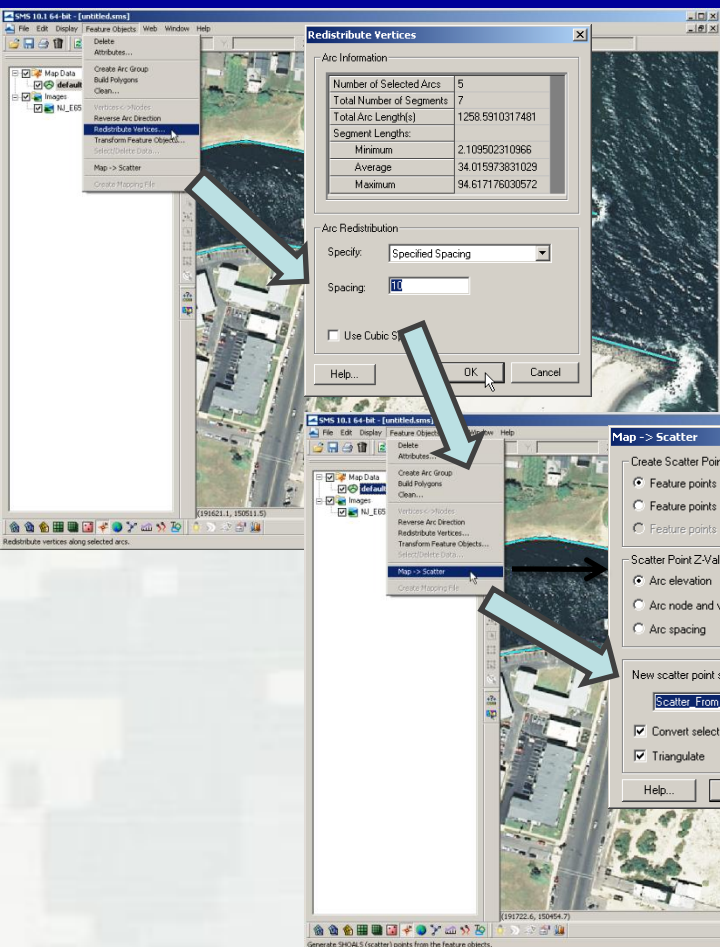
Type → Generic → Mapping/Observation/Shoals

Draw arcs (polylines) feature with 🖉 tool

Select arcs 🖉 and convert the z elevation to the desired contour elevation

Create Scatterset Points from Map Data

Select arcs to redistribute the spacing of vertices
Feature Objects → Redistribute Vertices
Specify Spacing based on horizontal coordinate system units (metric in this case)
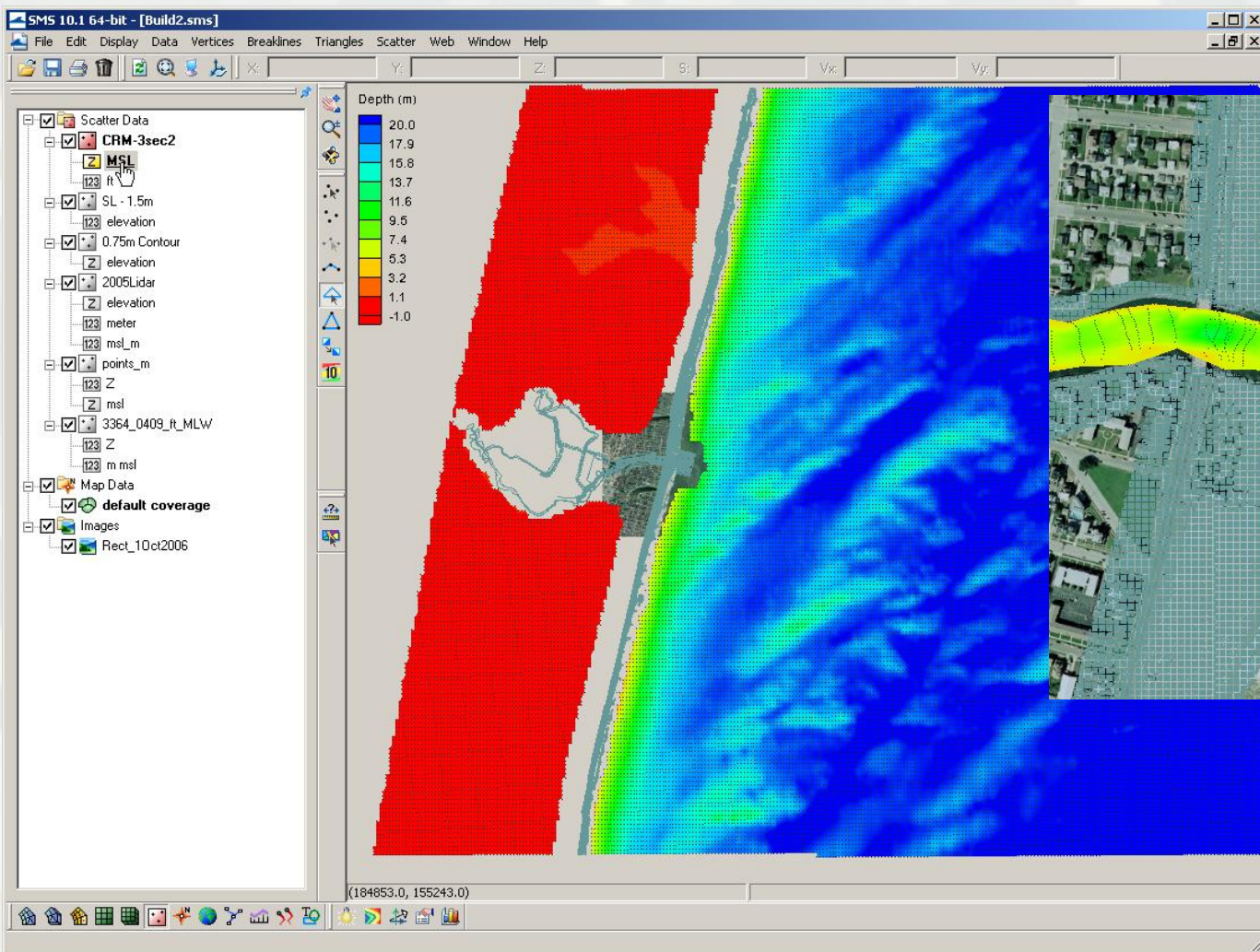
Feature Objects → Map>Scatter
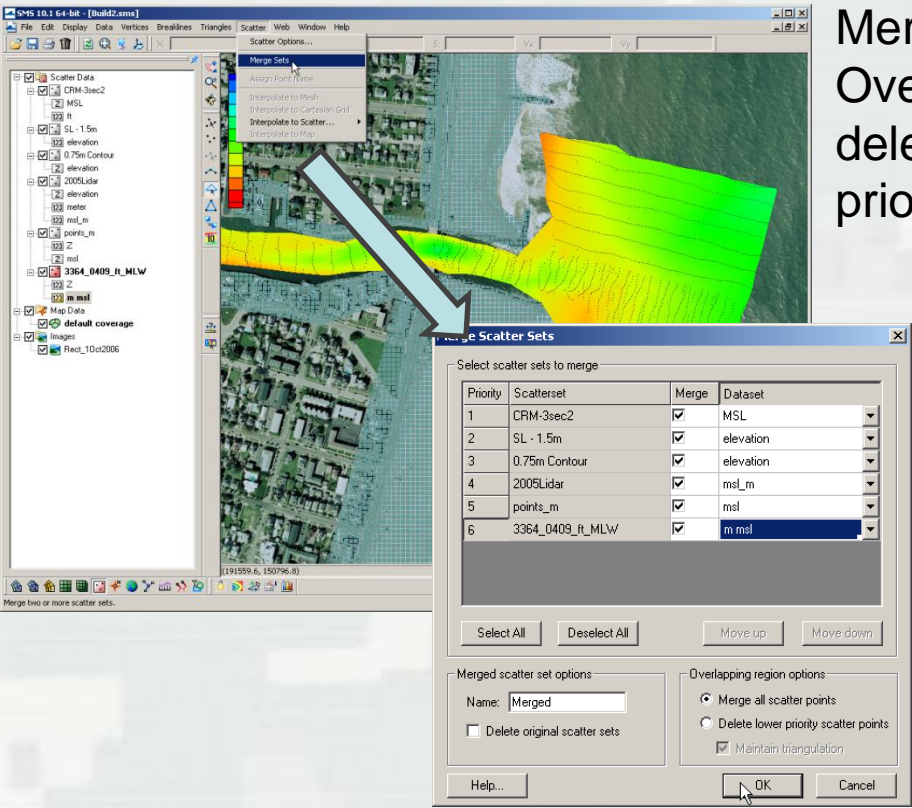Include Feature Pts and vertices and the Arc Elevations
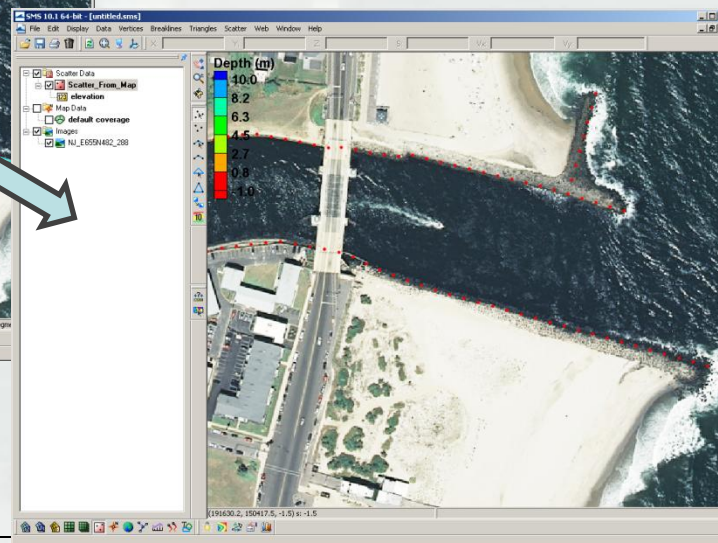
Delete unnecessary data points (check alignment and elevations in overlapping datasets)
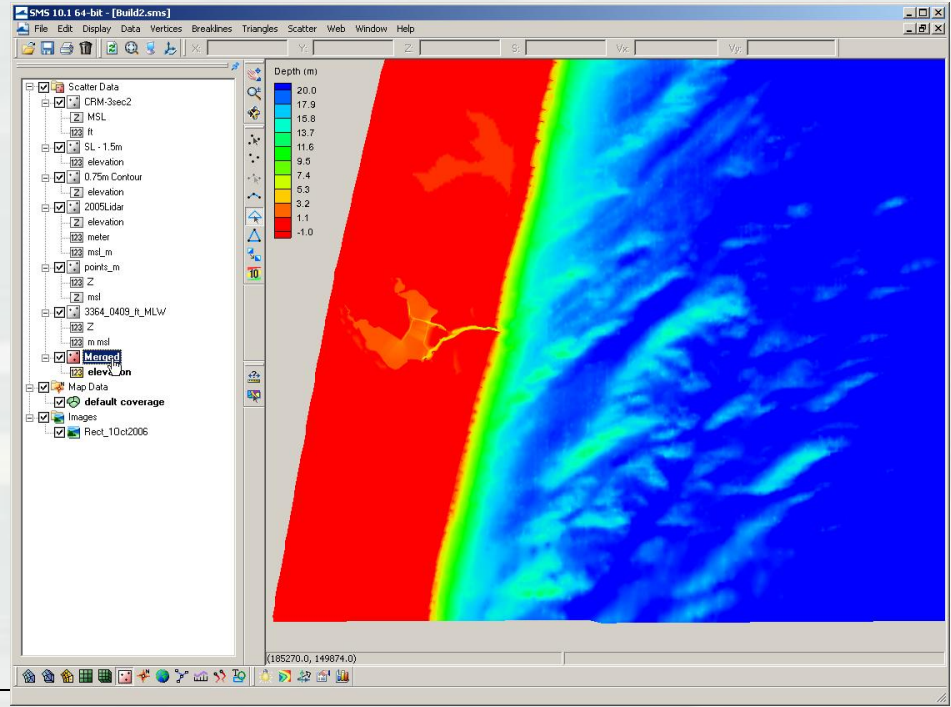
Merging Scattersets

Merging all scattersets will integrate all points. Overlapping areas of scattersets should either be deleted, or use a separate method of merging (by prioritizing using triangles).

Select the dataset

Questions?

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601-634-4036